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THE NAIADES OF MISSOURI.—VI.

BY WILLIAM I. UTTERBACK.

Nephronaias ligamentina (Lamarck).

Pl. XXV, Figs. 85 A and B.

1819—*Unio ligamentina* Lamarck, An. San. Vert., VI, p. 72.

1900—*Lampsilis ligamentina* Simpson, Proc. U. S. Nat. Mus., XXII, p. 539.

1912b—*Nephronaias ligamentina* (Lam.) Ortmann, An. Car. Mus., VIII, p. 325.

ANIMAL CHARACTERS.

NUTRITIVE CHARACTERS:—Branchial opening large with strong papillae; anal distinctly crenulated; supra-anal rather small, well separated from anal by thick mantle connection; gills very large, inner laminae of inner gills entirely connected to visceral mass; palpi very large, wide and pointed; color of soft parts dingy white for most part, however, post-mantle edge brownish.

REPRODUCTIVE STRUCTURES:—Marsupia occupying most of outer gills, consisting of about sixty ovisacs well separated by thick septa, when gravid extending far below original edge of sterile marsupium, making a longitudinal line; mantle edge antero-ventrad to branchial opening with twenty-five or thirty low denticulations; conglutinates white, broad, leaf-like, solid when ova are present, cohesion lost when mature glochidia are developed; glochidia semi-elliptical, spineless, large, hinge line undulate, measures 0.220 x 0.260mm.

SHELL CHARACTERS.

EXTERNAL STRUCTURES:—Shell rather evenly elliptical, solid, moderately inflated, beaks rather low, sculpture consisting of several fine, wavy, concentric lines most pronounced at foot of posterior and anterior slopes; disk smooth; epidermis brown or yellowish with broad, dark-green rays.

INTERNAL STRUCTURES:—Cardinals rather stumpy and stout; interdentum rather short and cut away; laterals very strong; nacre white with stippled effect—a very valuable shell commercially for this reason.

Sex	Length	Height	Diameter	Locality
♀	110	x	68 x	44.5mm (Marais des Cygnes, Rich Hill)
♂	110	x	65 x	43.5mm (Meramec R., Meramec Highlands)
♀	90	x	59 x	32.0mm (Osage R., Osceola)
♂	35	x	21 x	10.0mm (Gasconade R., Gascondy)
	15.5	x	8 x	4.0mm (St. Francis R., Greenville)
	8.5	x	5 x	3.0mm (St. Francis R., Greenville).

These last two measurements are those of *two byssiferous juveniles* identified by Dr. Howard and Prof. Clark. At first the writer was inclined to call them *L. luteola* chiefly on the grounds that both were found clinging by their byssi to a *costata* shell in a bed where *luteola* predominated; however, this identification was excluded on the basis of the presence of anterior rays and a difference of umbonal sculpture being less prominent with the ridges more broken in case of juvenile *ligamentina* as shown in these two specimens. The byssus is attached to the upper posterior part of the foot although it extends out antero-ventrad between the valves. In the smaller juveniles the byssus is about 120mm long, in the larger 135mm. Both bear dense papillae on both branchial and anal openings. Anterior end of outer gills lifted up very high above the palpi, gills dark tan-color; branchial papillae rusty red; epidermis yellowish with bright broad green rays—mostly placed anteriorly.

MISCELLANEOUS REMARKS:—While *N. ligamentina* may have the widest general distribution of the North American *Naiades*, yet it is not found anywhere in the interior of this State north of the Missouri River. However, it is the most common of species in the Mississippi, the Des Moines and in all the interior drainage south of the Missouri. It is not inclined to vary much from the typical *ligamentina* of Lamarck; however, the Osage River contains some forms that are somewhat puzzling due to ecological conditions that erode the epidermis and distort the shell of this species (and of other characteristically rayed species, for that matter), but these are of rare occurrence in the Osage from the center of its course to its mouth. As mentioned elsewhere this local effect may be traced to the chemical reaction of the mineral water of the springs' region. There are no species it may be confused with

except *N. ellipsi formis* when the former is young. However, the more elliptic shell with broader, straighter rays would serve as the main distinguishing features. Surber (1913, p. 109) has found that its glochidium is a gill parasite upon the white bass (*R. chrysops*) as a natural host. Breeding records have been carefully kept for this species, especially for commercial reasons, to find that it is typically bradytictic.

***Nephronaias ligamentina gibba* (Simpson).**

1900b—*Lampsilis ligamentinus gibbus* Simpson, Proc. U. S. Nat. Mus., XXII, p. 540.

("Southern Mucket," "Yellow Mucket.")

ANIMAL CHARACTERS:—Identical with those of the parent species, except, of course, in short gills and other modified parts due to a shorter shell. The glochidia are the same.

SHELL CHARACTERS:—Shell "peculiarly short, humped form" (Simpson); thicker, heavier more inflated with more roughened growth lines and more of a yellowish epidermis than the parent shell.

Sex	Length	Height	Diameter	Locality
♂	85	x 60	x 40mm	(Osage R., Monegaw Springs)
♀	80	x 64	x 40mm	(" " Linn Creek)
♀	89	x 70	x 38mm	(" " Bagnell)

MISCELLANEOUS REMARKS:—*Gibba* seems to be a rather common variety throughout the southern range of the species and is especially characterized by the short, stout, "humped" form of shell. Perhaps it bears the same relation to its species as *dakotana* Frierson does to *grandis* Say. The writer's experience in the study of the form of *ligamentina* while on a 300-mile float down the Osage was that it was difficult to ascertain the point of separation between the species and the variety, *gibba*, so imperceptibly do they grade into each other. This form is met with in drainage of the Ozark Center as well—especially in the Black River.

***Nephronaias ellipsiformis* (Conrad).**

("Ellipse.")

Pl. XXV, Figs. 86 A—D.

1836—*Unio ellipsiformis* Conrad, Monog. VIII, p. 60, pl. XXXIV, fig. I.

1845—*Unio spatulatus* Lea, Proc. Am. Phil. Soc., IV, p. 164.

1898—*Lampsilis spatulatus* Baker, Moll. Chicago, Pt. I, p. 106, pl. X, fig. 5; pl. XIII, fig. 2.

1900b—*Lampsilis ellipsiformis* Simpson, Proc. U. S. Nat. Mus., XXII, p. 557.

ANIMAL CHARACTERS.

NUTRITIVE STRUCTURES:—Branchial opening with numerous yellowish papillae; anal very finely papillose; supra-anal small, high, closely but distinctly connected to anal; gills large, pointed even in the marsupial ones; inner laminae of inner gills connected entirely to visceral mass; palpi sickle-shaped; color of soft parts the usual dirty white with posterior mantle edges blackened.

REPRODUCTIVE STRUCTURES:—Marsupium occupying posterior half of outer gills, consisting of about twenty ovisacs separated by thick septa, when gravid extending below the original edge of sterile marsupium, tips pigmented with bluish, beaded spots; mantle edge antero-ventrad to branchial opening with papillae terminating in rather fine crenulations centrad-ventrad; conglomerates and glochidia unknown.

EXTERNAL STRUCTURES:—Shell small, elliptical, dorsal and ventral lines about the same curvature; post-umbonal ridge rather rounded; beaks very low, usually eroded, even in the youngest shells, thus sculpture not seen; epidermis brownish-yellow with bright waved rays all over disk; no sculpturing on disk; shells somewhat sexually dimorphic, the female being rather swollen post-ventrad.

INTERNAL STRUCTURES.—Cardinals strong, upright; interdium large and thick; laterals short, stout, very slightly curved; beak cavities shallow; nacre white, sometimes with slight pinkish tinge and teeth rusty-red.

Sex	Length	Height	Diameter	Locality
♂	56	x 33	x 22.5mm	(Gasconade R., Gascondy)
♂	43	x 28	x 21.5mm	(Osage R., Warsaw)
♀	41	x 25	x 17.5mm	(" " , Proctor)
♀	35	x 22	x 7.5mm	(Niangua R., Hahatonka)

MISCELLANEOUS REMARKS:—This little striped shell is common throughout Central Missouri, but is never found anywhere in the interior north of the Missouri River and is rare in the southern drainage. Its shell may sometimes be taken for young *N. ligamentina*; however, the adult shells of these species are nothing alike. The anatomy of both are very similar; however, the inner mantle edge antero-ventrad to branchial opening is more specialized and indicates a step in advance. Hundreds of females were examined

daily throughout July and the first two weeks of August to find them sterile in every case. Since Wilson and Clark (1912, p. 48) report it gravid for an earlier date this incomplete breeding would indicate that it is bradytictic.

***Nephronaias ellipsiformis venusta* (Lea).**

Not figured.

1838—*Unio venustus* Lea, Tr. Am. Phil. Soc., VI, pl. II, fig. 4.

1900b—*Lampsilis venustus* Simpson, Proc. U. S. Nat. Mus., XXII, p. 543.

ANIMAL CHARACTERS:—Entirely identical with those of the species both as to nutritive and reproductive structures. No glochidia have been found.

SHELL CHARACTERS:—Also identical with the typical *ellipsiformis*-shell except for a small guttered furrow just antero-parallel to post umbonal-ridge of shell. The male shell of this sub-species is also more pointed posteriorly than the male type species.

Sex	Length	Height	Diameter	Locality
♂	60	x 37	x 22mm	(Niangua R., Hahatonka)
♀	55	x 31	x 22mm	(" " ")

MISCELLANEOUS REMARKS:—The writer heartily agrees with Mr. Walker that *venusta* is very closely related to *ellipsiformis* and also with Mr. Frierson's opinion, that it is only a form of *ellipsiformis*. The type locality for *U. venustus* of Lea is Potosi, Washington County, Missouri, and belongs to the Meramec River basin. Simpson (1900b, p. 543) only reports it for that locality. Since then Rev. Wheeler has reported it for Arkansas; so has Wilson and Meek (1912, p. 19.). The writer has only found it in the Niangua River. Having such limited distribution and such lack of discriminating features from *N. ellipsiformis* there should be no hesitancy in naming *venusta* as a variety. From *N. pleasii* this subspecies differs by a ticker, heavier, more coarsely rayed and more of a tawny colored shell.

***Nephronaias Pleasii* (Marsh).**

("Bleeding Tooth," "Pleas' Shell.")

Pl. XXV, Figs. A—D.

1891—*Unio pleasii* Marsh, "The Observer" (a newspaper), II, May; Nautilus, V. p. 2.

1900b—*Lampsilis pleasii* Simpson Pr. U. S. Nat. Mus., XXII, p. 557.

ANIMAL CHARACTERS:—No females have been secured by the

writer; however, the nutritive structures of the males are identical with those of *N. ligamentina* and *ellipsiformis*.

SHELL CHARACTERS.

EXTERNAL STRUCTURES:—Shell sub-elliptical, rather thin, smooth, somewhat compressed, rounded before, obtusely angular behind; beaks rather low, sculptured by three or four fine shaped undulations; epidermis brown polished horn, with numerous green capillary rays, disposed mostly posteriorly and showing through the thin shell on the inside.

INTERNAL STRUCTURES:—Cardinals small, single in right, double in left valve, erect and parallel with laterals; left inter-dentum cut away for post-cardinal tooth; beak cavities rather shallow; nacre bluish, coppery or salmon in umbonal cavity.

Sex	Length	Height	Diameter	Locality
♂	55	x 21	x 13 mm	(White R., Hollister)
♂	35.5	x 21.5	x 13.5 mm	(" " ")
♂	30	x 18	x 12 mm	(James R., Galena)

MISCELLANEOUS REMARKS:—According to 'Mr. Marsh this shell bears some resemblance to *Unio spatulatus* Lea (i. e., *U ellipsiformis* Conrad), but differs chiefly in being thinner, smaller and more compressed. It is like *venusta* in that the female shell is deeply emarginate or constricted in front of post-umbonal ridge as the writer determines from the author's description (1891, p. 2). This species was dedicated to Mr. Elwood Pleas of Indiana who collected this Species, together with many other rare Species, from South Missouri. It was also collected by Mr. S. M. Godbey at Morrisville, Polk Co., Missouri, who sent it to the National Museum where it is now recorded under the number, 132634. The writer found *pleasii* as a rather common shell in the White River, this State..

Nephronaias ozarkensis (Call).

(“The Ozark Shell.”)

(Not figured.)

1887—*Unio ozarkensis* Call, Pr. U. S. Nat. Mus., X, p. 498, pl. XXVII; 1895, Tr. Ac. Sci. St. Louis, VII, pp. 33-34, Pl. XVIII.

1900b—*Lampsilis ozarkensis* Simpson, Pr. U. S. Nat. Mus., XXII, p. 557.

ANIMAL CHARACTERS:—Reference to rough field notes show

that the soft parts are those of *Nephronaias*. The shell was identified later as *ozarkensis* of Call.

SHELL CHARACTERS.

EXTERNAL STRUCTURES:—Shell sub-elliptical, smooth, rather compressed; post-umbonal slope somewhat biangulate by siphonal ridges; beaks not prominent, sculptured by three fine undulations; epidermis brownish-yellow or olive with numerous fine green rays over central portion of disk; sexually dimorphic.

INTERNAL STRUCTURES:—Cardinals tend to double in both valves, laterals rather short, slightly curved; nacre usually white, sometimes salmon or pink, iridescent; muscle scars confluent.

Sex	Length	Height	Diameter	Locality
♀	55.0 x	35.0 x	21.0	(Jack's Fork, Current R.)
♂	54.5 x	32.7 x	15.2	(Jack's Fork, Current R.)

MISCELLANEOUS REMARKS:—The latter measurement is that of Call's taken for a shell from the same locality (which is one of the type localities of *ozarkensis*) as for the shell of the first measurement which is now in the hands of the writer through the kindness of Mr. B. F. Bush, but which is now too much damaged through shipment for figuring. Its shell is very much like that of *N. pleasinii* as to general outline, but is a little thicker and has a different nacre and epidermis. Forms of this species reported by Meek and Clark (1912, p. 18) for the White River drainage and described as like "a very elongated *Quadrula coccinea*" and also identified by Mr. Walker as "*Pleurobema* rather than species of *Lampsilis*" are doubtless only *Pleurobema utterbackii* of Frierson. Definite assignment to the latter may be made for shells received from the White River, Hollister, Missouri, under the name of *ozarkensis* with the note:—"although not having *Lampsiline* beak sculpture." The reader is invited to compare descriptions and illustrations of *Neph. ozarkensis* and *Pleu. utterbackii* and note that the shell of the former does not possess such tumid beaks, nor such a furrowed post-slope, nor such distinct muscle scars, and its shell has its whole facies of a thinner, lighter character, thus being more inclined to a *Lampsiline* structure.

Genus *Amygdaloniaias* Crosse and Fischer.

1893—*Amygdaloniaias* Crosse and Fischer, Jour de Conch., pp. 31-32;
1900b,—Simpson, Proc. U. S. Nat. Mus., XXII, p. 604 (as subgenus for *Plagiola*).

(Type, *Unio cognatus* Lea.)

ANIMAL CHARACTERS:—Anal opening crenulated; supra-anal widely separated from anal; inner laminae of inner gills connected to visceral mass except for a small posterior slit; palpi small; marsupia consisting of several ovisacs at posterior half of outer gill that acutely tapers; conglutinates white, undivided; glochidia smallest of all *Naiades*.

SHELL CHARACTERS:—Shell among the smallest, roundly triangular, inflated, flattened on post-dorsal slopes; post-umbonal ridge sharply angular; disk smooth; beak rather full, sculptured with a few ridges, the latter ones being rather definitely double looped; epidermis greenish to yellowish with characteristic paintings of green arrow-marked rays; female shell slightly more inflated post-ventrad; hinge teeth delicate; nacre usually white.

MISCELLANEOUS REMARKS:—Although this genus stands very close to *Obovaria* and *Nephronaias*, having essentially identical structures of soft parts, yet it deserves this compartment on account of its unique form, size and color markings of shell and especially upon its glochidial characters, being the smallest on record. The only two members of this genus are represented in this State by *A. donaciformis* (Lea) in North Missouri and by *truncata* (Raf.) in Central Missouri. The latter is never found north of the Missouri River and the former is rarely ever found in Central Missouri; neither have been found by the writer in South Missouri. The Osage River bears many intergrades for these two species.

***Amygdaloniaias donaciformis* (Lea).**

("Fawn's Foot," "Deer-Toe," "Zigzag.")

Pl. XXV, Figs. 89 A—D.

1828—*Unio donaciformis* Lea, Tr. Am. Phil. Soc., III, p. 267, pl. IV, Fig. 3.

1820—*Unio zigzag* Lea, Tr. Am. Phil. Soc., III, p. 440, p. XII, fig. 19.

1898—*Plagiola donaciformis* Baker, Moll. Chicago, Pt. I, p. 92, pl. XIII, fig. 4; 1900b, Simpson, Proc. U. S. Nat. Mus., XXII, p. 605.

ANIMAL CHARACTERS.

NUTRITIVE STRUCTURES:—Branchial opening small with numerous papillae; anal indistinctly crenulated; supra-anal separated by a long and thick mantle connection to anal; inner laminae connected to visceral mass except for a narrow slit

anteriorly; palpi small, connected one-half of their length antero-dorsad; color of soft parts dirty white except for blackish mantle edge at siphonal openings.

REPRODUCTIVE STRUCTURES:—Marsupia rather low on post-ventral portion of outer gills; when gravid the numerous distinct ovisacs extend below the original edge of gill; glochidia *smallest on record, measuring 0.600 x 0.063 min., semicircular, spineless, hinge line short, very slightly undulated*; conglutinates white, loosely connected when glochidia mature.

SHELL CHARACTERS.

EXTERNAL STRUCTURES:—Shell very small, compressed, rounded before, pointed high behind; post-umbonal ridge rather prominent; disk smooth; beaks rather full sculptured by five upward angled bars extending out as finer concentric lines in later bars; epidermis green or olivaceous, painted with radiating green rays of zigzag or arrow-marks; female shell inflated post-ventrad.

INTERNAL STRUCTURES:—Cardinals double in left, single in right valve, compressed, high and ragged; interdentum narrow; laterals single in right, faintly double in left; nacre pearl blue or white, rarely pink.

Sex	Length	Height	Diameter	Locality
♂	54 x	30 x	22mm	(Grand R., Gallatin)
♀	35 x	22 x	15mm	(Platte R., Dixon Falls)
♀	33 x	20 x	14mm	(" " Agency Ford)
♂	14 x	8.5 x	9.5mm	(Grand R., Darlington)
♀	11 x	7.0 x	4.5mm	(" " Chillicothe)

The last two are among the smallest juveniles in the writer's collection. The smallest meets with the following description:—Post-umbonal ridge sharply angled; beaks prominent, well up toward middle of dorsal line, sculptured by five early bars bowed upward in the center, the latter ones being rather fine, concentric; epidermis green with costa-like paintings on the post-dorsal ridge; disk with two rows of zigzag paintings parallel to the growth lines. Four juveniles of this species were found in the Osage clinging to one byssal thread, but unfortunately they were lost.

MISCELLANEOUS REMARKS:—Typical *donaciformis* may be easily distinguished from *Amyg. truncata* in possessing a smaller shell, more painted, thinner, less inflated, more dorsally ridged, and is more of an inhabitant of quiet water with mud-sand bottom. *Donaciformis* is more supplanted in Central Missouri by *truncata*

(Raf.), but, as stated before, it takes the place of the latter wholly in North Missouri. The North Missouri Grand River bears *donaciformis* in its most typical form. The writer finds this species most colonial in their habits, and has been able to find many of them nearly every month of the year, but has not found any gravid during the winter. The earliest date for the bearing of glochidia is June 19th. No previous public record has ever been made of this unique glochidium. From the above data it may be inferred that it is not bradytictic as is mostly the breeding habit of the *Lampsilinae*. This little mussel is also eccentric in that while in the parasitic stage it develops an adult shell five times the size of the glochidial one. Surber (1913, p. 109) finds that its specific distributor is "Sheep's Head" (*A. grunniens*).

***Amygdaloniaias truncata* (Rafinesque).**

("Deer-Foot," or "Deer-Toe.")

XXV, Fig. 88 A and B.

1820—*Unio truncata* Rafinesque, Ann. Gen. Sci. Phys. Brux.

1831—*Unio elegans* Lea, Am. Phil. Soc., IV, p. 83., pl. fig. 13.

1898—*Plagiola elegans* Baker, Moll. Chicago, Pr. I, p. 91, pl. XXI, fig. 1; 1900b, Simpson, Pr. U. S. Nat. Mus., XXII, p. 604.

1912b—*Amygdaloniaias elegans* (Lea) Ortmann, An. Car. Mus., XXII, p. 328.

ANIMAL CHARACTERS.

NUTRITIVE STRUCTURES:—Identical with those of *donaciformis*.

REPRODUCTIVE STRUCTURES:—Branchial mantle margin a little more thickened with slight crenulations than in *donaciformis*; glochidia a little larger, measuring 0.060 x 0.070 mm—otherwise these structures are identical with those of *donaciformis*.

SHELL STRUCTURES.

EXTERNAL STRUCTURES:—Shell short, roundly triangular, inflated; post-umbonal ridge sharply angulated from beaks to posterior point of shell; disk smooth; beaks rather prominent, sculptured with a few fine ridges more or less double-looped or sinuated; epidermis yellowish, brownish or even greenish with beautiful paintings of green broken by arrow-marked rays; no sex dimorphism of shell, both sexes being rather swollen post-ventrad.

INTERNAL STRUCTURES:—With the exception of a deeper and

more rounded out branchial cavity and somewhat coarser cardinals these structures are identical with those of *donaciformis*.

Sex	Length	Height	Diameter	Locality
♂	50	x 36	x 25 mm	(Osage R., Linn Creek)
♀	43	x 34	x 23 mm	(Gasconade R., Gascondy)
♀	38	x 30	x 17 mm	(Osage R., Schell City)
♂	37	x 27	x 16.5 mm	(" " Proctor)

MISCELLANEOUS REMARKS:—As pointed out under the description of *donaciformis*, *truncata* is as distinct when typical as its only con-generic ally—especially in its broadly truncated shell post-dorsad. Neither is *truncata* so sexually dimorphic; however, the male shell is unusually more elongated and pointed posteriorly and has less inflation. Both sexes have their shells rather expanded post-ventrad. This species is rarely found in South Missouri, (the writer not having made personal collections of it there at all) although it is really more of a southern species than *donaciformis*. It is not to say very typical in the Osage or Gasconade basins where there are many intergrades for it and its ally, but reaches its greatest perfection in the Mississippi. The breeding habits of this species is the same as that of *donaciformis* as far as records show.

Genus *Plagiola* Rafinesque.

1819—*Plagiola* Rafinesque, J. de Phys. Chim. Hist. Nat., p. 426; 1852, Agassiz, Arch. Fur Nat., p. 48, (redefined); 1900b, Simpson, Pr. U. S. Nat. Mus., XXII, p. 603.

(Type, *Unio securis* Lea.)

ANIMAL CHARACTERS:—Anal opening smooth, connected to supra-anal by close mantle attachment; inner laminae of inner gills free or partly connected to visceral mass; gills brownish—all other soft parts tannish; marsupium rather reniform consisting of 40-50 well defined ovisacs; conglomerates lanceolate, not very solid; glochidium spatulate, very much higher than long, spineless, very large.

SHELL CHARACTERS:—Shell sub-triangular, solid, not greatly inflated, with square cornered post-umbonal ridge and flat post-dorsad; disk smooth; beaks pointed, rather high, sculptured with faint double-looped ridges; epidermis yellow with broken rays; cardinals low and jagged; laterals rather stout, straight or slightly curved; nacre white.

MISCELLANEOUS REMARKS:—The chief characteristic of this

genus is in its peculiar shell and glochidial characters. As to its animal characters it is essentially that of *Obovaria* and *Amygdalonaia*s. Because of its spatulate and higher-than-long glochidia there is "a transition," as Dr. Ortmann aptly puts it, "toward the glochidia of the *Proptera-type*," which has essentially the same hinge line and rounded ventral margin, but with different posterior and anterior ends.

***Plagiola securis* (Lea).**

(Butterfly.)

Pl. II, Figs. 5a—6b.

1829—*Unio securis* Lea, Tr. Am. Phil. Soc., III, p. 437, pl. XI, fig. 17.

1834—*Unio lineolata* Say,¹ Am. Conch., VI.

1906b—*Plagiola securis* (Lea) Simpson, Proc. U. S. Nat. Mus., XXII, p. 603.

ANIMAL CHARACTERS.

NUTRITIVE CHARACTERS:—Branchial opening rather small with numerous papillae; anal crenulated; supra-anal very large closely, but definitely connected by mantle edges to anal; anus tentacled; inner laminae of inner gills free about three-fourths of their length from the visceral mass; palpi large, connected one-third of their length antero-dorsad; color of soft parts tan, or cream color with gills brownish and papillae yellowish.

REPRODUCTIVE STRUCTURES:—Marsupium composed of about twenty-five ovisacs placed in the posterior half of outer gill; mantle border antero-ventrad to branchial opening with about fifteen very low, irregularly placed papillae; marsupium when charged with ripe glochidia color of brown sugar, somewhat kidney shaped; conglutinates not very solid; glochidia subelliptic or spatulate hinge line very short, ventral margin round, spineless, much higher than long (0.230 x .330mm).

SHELL CHARACTERS.

EXTERNAL STRUCTURES:—Shell sub-triangular, not very much inflated, compressed in umbonal region, truncated narrowly post-dorsad; disk more or less smooth; beaks somewhat pointed and directed anteriorly, sculptured with a few fine concentric

¹ This name, as employed by Say, was really preoccupied by Rafinesque in his Monograph of 1820 and hence through priority this species should bear the name *Plagiola lineolata* (Raf.) in spite of the fact that Simpson considered this as one of the many "indeterminates" of Rafinesque.

and indistinctly double-looped ridges; post-umbonal ridge square cornered from beaks to post-extreme; epidermis yellowish or light brown painted with rays broken into square or lunate blotches; female shell smaller, thicker, shorter and more inflated than male.

INTERNAL STRUCTURES:—Cardinals rather low, ragged the right one having four vertical subparallel ridges; interdentum broad; laterals stout, rather long and sharply inclined; beak cavities, moderately deep; nacre silvery white, iridescent.

Sex	Length	Height	Diameter	Locality
♂	96 x	79 x	33mm	(Merame R., Meramec Highlands)
♀	70 x	56 x	37mm	(Marais des Cygnes, Athol)
♀	67 x	53 x	30mm	(Miss. R., Hannibal)
♂	48 x	36 x	16mm	(" " LaGrange)

MISCELLANEOUS REMARKS:—*P. securis* being more of a marine type of shell than fresh water renders it worthy of the creation of a genus. The young shell is like that of an "exquisite shell from the sea-shore," so narrowly flattened is it post-dorsal portion of shell, so delicately painted with broken lunate rays and so arched forward are its compressed and pointed umbones. This species is not found at all in the interior north of the Missouri River; neither is it found in Southwest Missouri. It is rather common in the Osage, Gasconade and Meramec though not very typical as a rule. The most perfect *securis* is the Mississippi. The writer found this species from the Mississippi bearing ripe glochidia June 22nd; Wilson and Clark (1914, p. 52) found the Cumberland *securis* in the same gravidity June 3-16. Dr. Ortmann finding it gravid in late fall again fixes its breeding season as normally bradyctic.

Genus *Lasmonos* Rafinesque.

1820—*Lasmonos* Rafinesque, Monograph, Ann. Gen. Sci. Phys. Brux.

1911b—*Paraptera* Ortmann, Mem. Car. Mus., IV pp. 331, 334, 338.

(Type, *Lasmonos fragilis* Rafinesque.)

ANIMAL CHARACTERS:—Siphonal openings large inclined to be tubular; supra-anal high, well separated from anal; inner laminae of inner gills entirely connected to visceral mass; palpi free their whole length post-dorsad, color of soft parts grayish with yellowish papillae on blackened mantle edge or branchial opening; marsupium kidney-shaped, consisting of several ovisacs occupying posterior part of outer gills; conglutinates white, leaf-like, not

very solid; glochidia very small, sub-ovate; spineless, hinge line short, slightly curved.

SHELL CHARACTERS:—Shell thin, sub-elliptical, alated, compressed; post-umbonal ridge lacking; disk smooth; unbones low marked with fine concentric lines followed by later double-looped bars; epidermis glistening tawny, rayed; sex-dimorphism shown in wider more blunt vertically at posterior end of female shell; hinge teeth reduced to rudiments.

MISCELLANEOUS REMARKS:—This genus is also constructed on the basis of characters relating to shell and glochidia rather than to anatomical structures. On basis of glochidial characters alone it classes with *Amygdalonaia*s, however its shell characters throw it near to the genus *Proptera*. *Lasmonos* is represented in this State by its type (which is the commonest shell in North Missouri) and by *simpsoni* Feriss. The latter is grouped here tentatively until its soft parts are studied as its shell characters more closely relate it to the type of this genus than to any other. The species, *Leptodea leptodon* Rafinesque, is perhaps congeneric here and much depends upon its marsupial and glochidial characters, which are as yet unknown; however, the writer has not been fortunate enough to secure live specimens of this species (not even dead shells) in this State, but, because of the use Rafinesque made of it, we are concerned here for nomenclatural reasons, *for should it be found to be really congeneric with fragilis, aside from its several shell characters, the generic name, Leptodea, would take preference to the one herein used.*

***Lasmonos fragilis* Rafinesque.**

("Paper Shell," "Razor Back.")

Pl. IX, Fig. 19; Pl. XXVI, Figs. 90 A—D.

1820—*Lasmonos fragilis* Rafinesque, Mono. Biv. of Ohio.

1823—*Unio gracilis* Barnes, Am. Jl. Sci., VI, p. 274.

1861—*Unio dolosus* Lea, Jl. Phil. Ac., V, p. 75.

1900b—*Lampsilis gracilis* Simpson, Pr. U. S. Nat. Mus., XXII, p. 573.

1912b—*Paraptera gracilis* Ortmann, An. Car. Mus., VIII, p. 331.

ANIMAL CHARACTERS.

NUTRITIVE STRUCTURES:—Branchial opening round, with spreading, yellowish tentacles; anal slightly crenulated, with thickened edges and normal diaphragm; supra-anal long, extending to dorsal ala, usually closed; mantles parallel at edges, dark colored

and thickened on edges of siphonal openings, white patch at base of branchial papillae, crenulated along border in front of branchial opening, post-ventral region of mantle darker than that of female; palpi united only at base, very long in old specimens; foot large, powerful, very extensile; gills dark tan, pointed posteriorly, inner gills longer and broader than outer, inner laminae of inner gills entirely connected to visceral mass.

REPRODUCTIVE STRUCTURES:—Marsupia occupying posterior part of outer gill, reniform, consisting of about forty, leaf-like ovisacs and, when gravid, extending beyond original edge of gills, the extreme thickness of tissue here allowing the bulging out until glochidia escape through the ruptured edge; conglutinates white, elongate, leaf-shape, not very solid, usually surrounded with brick-red matter; glochidia among the very smallest (0.085mm. by 0.075mm.) belonging to the *Lampsilis* type (i. e., semi-elliptical, ventral margin rounded, gaping, hookless, short hinge line which is slightly undulate.)

SHELL CHARACTERS.

EXTERNAL STRUCTURES:—Shell medium in size, thin, alate, posterior end of female shell blunt; beaks compressed, marked with three or four wrinkles arranged in a double loop ending with two or three rather nodulous elevations at the base of the post-umbonal slope; epidermis straw color with bright green rays in young and well preserved specimens.

INTERNAL STRUCTURE:—Cardinal teeth very weak, single in each valve; lateral teeth more solid, long, lamellar, elevated, no interdentum; muscle scars faint, retractor large and peculiarly placed; beak cavity shallow; nacre pearl-blue with the usual characteristic pink on the posterior portion.

Sex	Length	Width	Diameter	Um. ra.	Locality
♀	80	x	40	x	23 0.250 (Perche Cr., Columbia)
♂	140	x	70	x	47 0.210 (Grande R., Utica)
♀	74	x	38	x	26 0.275 (Platte R., Agency Ford)
♀	70	x	37	x	25 0.283 (102 R., St. Joseph)
	21.5	x	11	x	5.5 0.260 (Osage R., Colley's Ford)

BYSSIFEROUS JUVENILE:—The latter measurement is taken from a juvenile collected in the Osage River, Colley's Ford Mo., July 15, 1913. It possessed a byssus 160mm. long and was attached to a plicate shell. This byssal thread was so strong that it pulled off with some difficulty and was split in three strands near its

base, each being marked by a muscilaginous substance. The umbonal markings of this flat straw-colored juvenile shell consists of four broadly inverted V-shaped ridges the rear line being finer, longer and closer together, extending down the posterior umbonal ridge.

MISCELLANEOUS REMARKS:—*L. fragilis* is distinctly a river form for this State, although we would naturally think that this alated and thin-shelled species would be established in the lakes and other quiet waters of Northwest Missouri, especially where it predominates the streams. Breeding records for this species show that it may bear glochidia every month of the year except for a few weeks in mid-summer; hence, a very long period breeder. It was found in August distending its ovisacs with water preparatory to ovulation. Only two other species possess smaller glochidia—those of *Amygdalona* *donaciformis* (Lea) and *A. elegans* (Lea) with which *fragilis* is closely related; however, external characters of shell alone—especially as to size and form—show no close connection. *Fragilis* may be distinguished from other similar alated forms by its peculiar yellow surface, marked by brown horn-colored restlines, depressed umbones, green rays in young and broadly elliptical outline in old specimens, if their alae are lost as is often the case. Through special cooking tests the writer has found out that nearly all the soft parts of this species is very edible. It is also economically important in producing pearls, since it is easily parasitized. No mussel is more active and as it anchors itself so firmly it is often extracted from its bed with great difficulty. The straw-colored and green rayed juveniles are easily located, not so much by color as by their “tracks” since they are the most active crawlers. This species is the most abundant in the One-Hundred-and-Two, Platte, Grand, Tarkio, Osage—in fact all the streams of Northwest and Central Missouri as determined by personal collections. It is poorly developed in the Osage and is not found at all further South in the clear-water streams of the Ozarks. Simpson reports it for the Missouri River, but I think he means only for the tributaries of the Missouri as no mussel life is actually reported in the main stream of this River throughout the State. Its general distribution is for the entire Mississippi River drainage; St. Lawrence system; Red River of the North; Eastern Texas and Cumberland River.

(To be continued.)